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(54) FILTER CARTRIDGES

(71) We, TECAFILTRES, a French body corporate, of Ancienne Route de Fontainebleau, 91550 Paray Vieille Poste, France, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to filter cartridges, particularly for use in air filters but also for use in filters for any fluids, for engines of motor cars or similar vehicles, or for any industrial application requiring the use of such filters.

In filters known at the present time, the filter cartridge usually comprises a filter element proper which is provided with a sealing element at each of its ends, the said sealing element being subjected to axial constraints to ensure the sealing-tightness desired in a housing of the filter.

According to the present invention there is provided a filter cartridge comprising a tubular filter element having an annular sealing element covering the whole annular area of each end of the tubular filter element, each sealing element having a peripheral rim the general plane of which is in radial alignment with the rest of the corresponding sealing element, each peripheral rim being radially compressible and adapted to make sealing contact with a filter housing when the filter cartridge is positioned therein, each peripheral rim being divided into a pair of smaller rims or lips for enhanced flexibility.

Such a filter cartridge obviates disadvantages of the above-mentioned known filters by using radial, instead of axial, constraints on the sealing elements with which the filter element is provided.

The following description and the accompanying drawings show, on the one hand, features of filters relying on axial constraints for sealing and, on the other hand, the way in which filter cartridges may be constructed in accordance with six different embodiments of the present invention and the way in which the housings

of the filters to receive these cartridges may be arranged. In the drawings:—

Fig. 1 is an axial sectional view of an air filter of known type;

Fig. 2 is an axial sectional view of a known air filter having sealing elements on the cartridge and other sealing elements on the housing of the filter;

Fig. 3 is an axial sectional view of an air filter using a cartridge according to a first embodiment of the invention;

Fig. 4 is an axial sectional view of an air filter using a cartridge according to a second embodiment of the invention;

Fig. 5 is an axial sectional view of an air filter using a cartridge according to a third embodiment of the invention;

Fig. 6 is an axial sectional view of an air filter using a cartridge according to a fourth embodiment of the invention;

Fig. 7 is an axial sectional view of a filter cartridge according to a fifth embodiment of the invention;

Fig. 8 is an axial sectional view of a filter cartridge according to a sixth embodiment of the invention.

Referring to the drawings, Fig. 1 shows a filter of known type whose housing comprises a cover 1 which is made sealing-tight on a casing 2 by clamping a sealing element 3 by means of a central bolt 4. The filter cartridge 5 comprises a filter element proper 6 of any kind and, on its two end faces 6—1 and 6—2, two sealing elements 7 and 8 which, by their form and by the compression which the bolt 4 exerts on them, ensures the sealing-tightness of the cartridge 5 on the casing 2 and the cover 1. The sealing elements 7 and 8 are clamped parallel to the axis of the filter; the materials are subjected to considerable compressive stress and consequently the component parts of the filter element 6, the cross-sections of the sealing elements 7 and 8, the shapes and thickness of the casing 2 and the cover 1 have to be carefully considered. The clamping of the bolt 4 thus at the same time ensures the sealing-tightness of the cartridge and also the sealing-tightness of the cover-

casing assembly; therefore, in order to compensate for the tolerance range of the parts which are stacked on one another, it is necessary either to rely on the elasticity of the cover 1 or to provide the sealing elements 7 and 8 with lips 7—1 and 8—1 or beads 7—2 and 8—2 (Fig. 2) which gives a wider clamping range.

However, given the small choice of the materials which can be used for this kind of apparatus, creep phenomena are likely more particularly under the action of heat, and the sealing-tightness which would be acceptable at the first clamping is progressively destroyed during the course of time.

Since the appearance of casings and covers made of plastics material it has been necessary to use sealing joints provided with lips, since it has not been possible to clamp as strongly as was possible on metal casings and covers.

It has also been attempted to separate the sealing of the casing on the cover from the sealing of the cartridge in the filter housing. Fig. 2 shows this kind of filter which uses substantially two covers, one cover 9 clamping the sealing element 3 on the casing 2, and the other cover 10 compressing the sealing elements 7 and 8 in order to ensure the sealing-tightness of the cartridge 5. This arrangement complicates assembly and scarcely improves the reliability of the sealing-tightness in the course of time, since the materials relax all the more when they have been subjected to considerable stress.

Filter cartridges according to the present invention obviate the aforesaid disadvantages, separating the two necessary sealing functions in the assembly of the cartridge in a filter housing, namely: on the one hand, the sealing-tightness between the housing and the ends of the cartridge and, on the other hand, the sealing-tightness of the cover on the casing of the filter housing.

In a first embodiment of the invention shown in Fig. 3, the filter cartridge is constituted by a hollow cylindrical filter element 11 of any kind, provided at its ends 11—1 and 11—2 with plastics material and elements forming sealing elements 12 and 13, the assembly being made of the materials normally used in known filters or materials having similar properties. The sealing elements 12 and 13 have internal peripheral rims 14 and 15 which are radially compressible and each divided into a pair of smaller rims or lips (as described in more detail hereinafter with reference to Fig. 7) for enhanced flexibility. The rims provide radial sealing-tightness on a cylindrical internal wall of the casing 17, which is made of metal or a moulded plastics material, and on a cylindrical internal wall 18 of the cover 19 or a false cover 20 fixed on the inside of

this cover 19, the cover 19 and the false cover 20 being made of metal or constituted by a single part moulded from plastics material.

Sealing-tightness is achieved in the manner of a part-toroidal sealing element sliding on a shaft. The central bolt 21 only brings about the compression of the annular sealing element 22 which seals the cover 19 on the casing 17, but its clamping does not exert any stress on the side sealing elements 12 and 13 of the filter cartridge. These are compressed radially in directions 23 and 24 once and for all, and to an extent which is just sufficient and is known in advance from the diametral dimensions given to the contacting parts, to ensure sealing-tightness of the two ends of the filter cartridge when the latter is put in position in the housing of the filter; the reliability of the sealing elements over a period of time is thus ensured.

Since the clamping of the bolt 21 is limited to the force for compressing the sealing element 22, the stresses acting on the casing 17 and the cover 19—20 are small, which thus makes it rational to use plastics material for the production of these two parts. Limiting travel by means of a spacer element 21—1 makes it possible, if necessary, to limit the clamping of the bolt 21 to a suitable value. In this assembly it is arranged that the clearance 20—2 between the cover 19—20 and the sealing element 12 is established so as to cover, on the one hand, the amount of deformation of the parts when the bolt 21 is clamped and, on the other hand, all the tolerances provided in those parts, the casing-cover assembly on the one hand and the filter cartridge on the other hand. Since the position of this cartridge in the axial direction relatively to the casing-cover assembly is no longer a factor in sealing-tightness, the aforesaid tolerances can be very wide, which makes the production of the parts easier and reduces their cost price. Also it is no longer necessary, as it is in known filters, to make the cover strictly parallel with the bottom of the casing, which is also a factor in simplifying production and reducing the cost price.

In a second embodiment of the invention (Fig. 4), the filter cartridge is constituted by parts which are similar to those of the first embodiment but the plastics material end elements forming sealing elements 12 and 13 have their peripheral rims external instead of internal so as to provide a radial seal on the lateral wall 17—1 of the casing 17 which is made of metal or a moulded plastics material, and on a cylindrical vertical wall 20—1 of the false cover 20 fixed inside the cover 19, the cover 19 and the false cover 20 being made of metal or constituted by a

single moulded part of plastics material.

As in the case of the first embodiment, sealing-tightness is achieved in the manner of a part-toroidal sealing element which will be covered by a bell and will be able to slide axially thereon. The central bolt 21 only ensures the compression of the sealing element 22 which provides a seal for the cover 19 on the casing 17, but its clamping does not subject the sealing elements 12 and 13 to any stress. These are compressed radially in the directions 27 and 28 once and for all and to an extent which is just sufficient and is well known in advance from the diametral dimensions given to the contacting parts, to ensure the sealing-tightness of the two ends of the filter cartridge when the latter is put in position in the housing of the filter, and the reliability of these sealing elements over a period of time is thus ensured.

The advantages inherent in this device and described in connection with the first embodiment of the invention are all found again in this second embodiment and in the following embodiments.

The third embodiment of the invention, shown in Fig. 5, combines the features of the first and second embodiments: the sealing element 12 provides its radial sealing-tightness by its external peripheral rim 25 bearing against a vertical cylindrical wall 20—1 integral with the cover 19—20, and the sealing element 13 achieves its radial sealing-tightness by its internal peripheral rim 15 bearing against a vertical cylindrical wall 16 projecting from the casing 17.

The fourth embodiment of the invention (Fig. 6) also combines the features of the first and second embodiments: the sealing element 12 achieves its radial sealing-tightness by its internal peripheral rim 14 bearing against the cylindrical wall 18 integral with the cover 19—20, and the sealing element 13 provides a radial seal by its external peripheral rim 26 bearing against the side wall 17—1 of the casing.

In order to permit the filter cartridge to be mounted in any of the filter covers and casings described for any of the previous embodiments, in a fifth embodiment of the invention shown in Fig. 7, the two end sealing elements 12 and 13 are made with both radially inner and radially outer peripheral rims which are each radially compressible, the sealing-tightness given by the compression of these compressible rims being further improved by dividing each of them into two or more juxtaposed smaller rims 29 and 30 whose radial cross-section (semi-circular, square, triangular or trapezoidal) is designed so as to require a minimum amount of force for compressing them when the cartridge is positioned in the filter body.

The peripheral rims of the sealing elements 12 and 13 can also be made larger, in the form of double lips 33 and 34 (Fig. 8) of any desired shape. The flexibility of these lips makes it possible to obtain excellent sealing-tightness with the cylindrical walls of the cover and the casing on which they come to bear, whilst exerting a minimum force in the radial direction, thus reducing the stressing of the plastic material which is used, and therefore the risk of this material being subjected to creep, and allowing very wide tolerances on the diametral dimensions. Fig. 8 shows this arrangement of the lips, which constitutes the sixth embodiment of the invention. These double lips provide bearing contacts at two points on the cylindrical corresponding walls of the casing and the cover, and thus further improve the sealing effect which is obtained.

All these filter cartridges can be provided with lips 25 and 36 on the upper or lower faces 37 and 38 of the sealing elements 12 and 13. These lips, which do not contribute to the provision of the sealing-tightness of the cartridge, which is effected radially by the devices described hereinbefore, make it possible to centre the cartridges as regards height in the body of the filter, and also make it possible to use this cartridge in known filter housings constructed in accordance with the arrangements shown in Fig. 1 or Fig. 2.

The scope of the invention extends to any filter cartridge which differs from those described only as regards the particular shapes of the parts of the sealing elements constituting the radially inner or radially outer peripheral rims each divided into a pair of smaller rims or lips, the forms and materials of the sealing elements and the filter element proper, the shape and positions of the means provided on the cover and the casing for co-operating radially with the sealing means of the sealing elements of the filter cartridge, and more particularly the cylindrical walls may be replaced by frusto-conical walls, and the cover and the casing as well as the filter cartridge can be given a cross-section perpendicular to the axis, no longer circular, but oval or any desired shape.

The scope of the invention also extends to all possible combinations between the sealing means and the walls which co-operate with these means in the various embodiments described hereinbefore.

WHAT WE CLAIM IS:—

1. A filter cartridge comprising a tubular filter element having an annular sealing element covering the whole annular area of each end of the tubular filter element, each sealing element having a peripheral rim the general plane of which is in radial alignment

- with the rest of the corresponding sealing element, each peripheral rim being radially compressible and adapted to make sealing contact with a filter housing when the filter cartridge is positioned therein, each peripheral rim being divided into a pair of smaller rims or lips for enhanced flexibility.
2. A filter cartridge according to claim 1, wherein the peripheral rims of the sealing elements are at their radially inner peripheries.
3. A filter cartridge according to claim 1, wherein the peripheral rims of the sealing elements are at their radially outer peripheries.
4. A filter cartridge according to claim 1, wherein the peripheral rim of one of the sealing elements is at its radially outer periphery and the peripheral rim of the other of the sealing elements is at its radially inner periphery.
5. A filter cartridge according to claim 1, wherein each sealing element has both radially inner and radially outer peripheral rims each divided into a pair of smaller rims or lips.
6. A filter cartridge according to any of the preceding claims, wherein another lip is provided on the outer end face of one or each of the annular sealing elements intermediate the radially inner and radially outer peripheries thereof.
7. A filter comprising a filter cartridge according to any of the preceding claims disposed in a filter housing comprising a cover and a casing, with the rims of the sealing elements being radially compressed against portions of the housing to make seals therewith, another annular sealing element being disposed between the casing and the cover and compressed by a bolt fastening the cover to the casing without compressing the cartridge itself.
8. A filter according to claim 7, wherein the peripheral rim of one of the sealing elements sealingly engages the cover or a portion secured thereto, and the peripheral rim of the other sealing element sealingly engages the casing.
9. A filter according to claim 8, wherein the portions of the casing and cover in engagement with the peripheral rims of the sealing element are substantially cylindrical.
10. A filter cartridge substantially as described herein with reference to or as illustrated in Fig. 7 or Fig. 8 of the accompanying drawings.
11. A filter substantially as described herein with reference to or as illustrated in any of Figs. 3 to 6 of the accompanying drawings.

Agents for the Applicants,
 STANLEY, POPPLEWELL, FRANCIS &
 ROSS,
 Chartered Patent Agents,
 20/21 Took's Court,
 Cursitor Street,
 London, EC4A 1LB.

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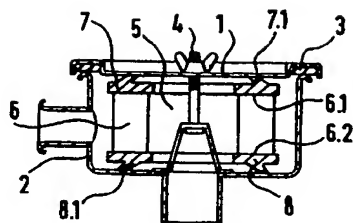


FIG. 1

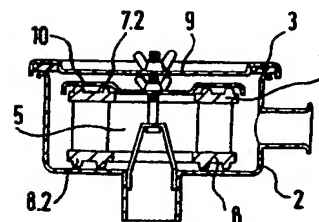


FIG. 2

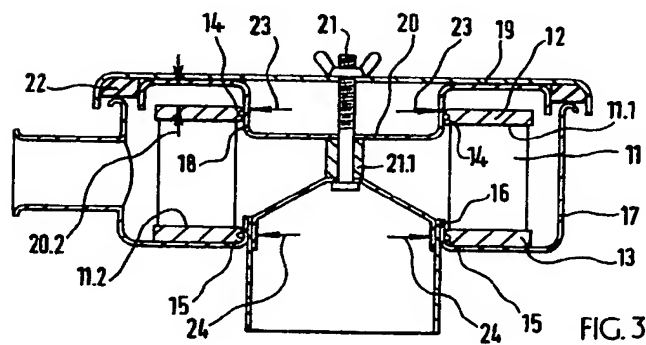


FIG. 3

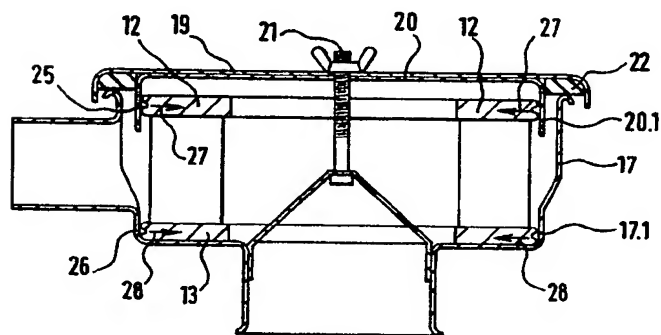
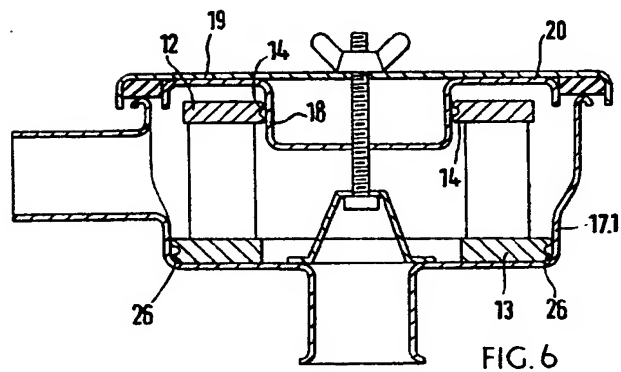
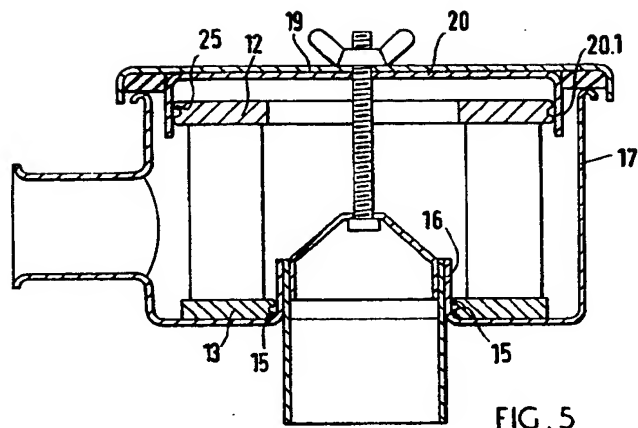


FIG. 4



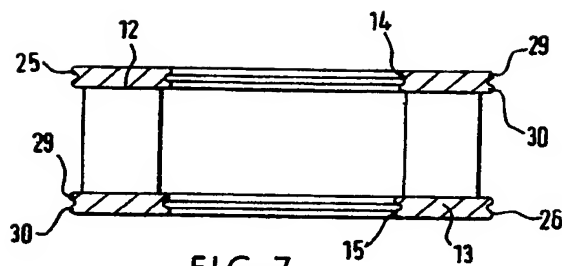


FIG. 7.

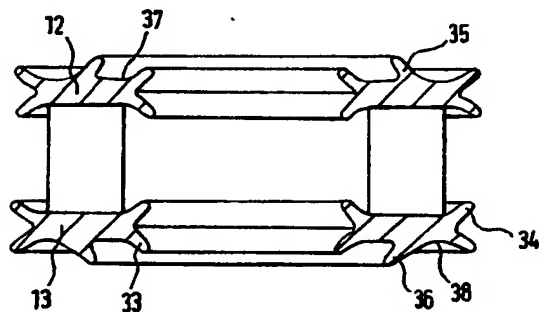


FIG. 8.

